Tests of Fixed-wing and Rotary-wing UAS for Photo-identification of Bowhead Whales

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INTRODUCTION

Unmanned Aerial Systems (UAS) are quiet, smaller than manned aircraft, and have the potential to collect information on marine mammals and birds currently collected with manned aircraft. They have the potential to reduce costs of data collection—particularly in remote Arctic environments—, have a lower environmental footprint, and are smaller and quieter than manned aircraft and, therefore, less likely to elicit a response from the wildlife species being overflown. While use of UAS to collect these data would likely be effective, they have not been specifically tested for these purposes. Photographs of bowhead whales would provide life-history information which has been collected with manned aircraft to date.

Two different platforms were tested: the Brican TD100 and the DJI Phantom 3 Professional (Figures 1 and 2).

Figure 1. TD100 UAS

Figure 2. DJI Phantom 3 Pro

OBJECTIVES

1) Develop protocols for collecting imagery with UAS being operated under visual-line-of-site Special Flight Operations Certificates, and
2) Collect imagery to assess whether individual bowheads can be identified and measured.

METHODS

Two pilots and two ground control stations for the TD100 were used to meet the line-of-sight requirements. One pilot on shore flew the UAS half way to the ice edge (Fig. 3) where the second pilot assumed control and flew the UAS over whales from the ice edge and from a boat.

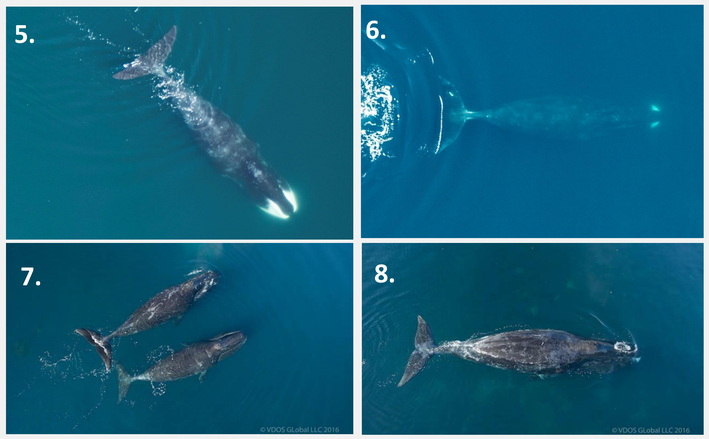
The Phantom 3 Pro was launched and recovered from a 8.2 m aluminum boat with a pilot controlling the UAS and a spotter following the UAS and retrieving it by hand after a flight (Fig. 4).

Figure 3. Tent and UAS launcher on beach.

Figure 4. Aluminum boat with the pilot sitting on the bow (taken by the UAS).

RESULTS

Both systems were tested and flown successfully. Three test flights and two flights over water were conducted with the TD100 and 19 whale images of 12 different whales were obtained (Fig. 5, 6). A total of over 1800 still photos were taken with the Phantom 3 Pro with most of them containing whales or to document sampling during a bowhead whale feeding study (Figs. 4, 7, 8) and identities of tagged whales.



Figures 5-8. Bowhead Images taken with the TD100 near Igloolik, Nunavut, June 2013 and the Phantom 3 Pro near Pangnirtung, Nunavut, August 2016.

DISCUSSION

UAS flights under visual-line-of-sight restrictions can successfully obtain high resolution imagery to identify individual whales. The imagery is at least as good and appears to be superior to the imagery currently collected using manned aircraft. The two systems tested have different advantages. The Phantom 3 Pro is inexpensive and the camera system does not have high quality optics but distortion is low in photographs taken at low altitude and so is as good as imagery taken with high-quality cameras in manned aircraft. A major drawback of the Phantom 3 Pro is the lack of a reliable method for obtaining distance from the camera to the target. That means accurate measurements from whales can only be obtained if a scale, such as a boat, is visible in the whale photo. Another disadvantage is that the Phantom 3 Pro can only operate for 12-14 min. in the cold air temperatures encountered in the Arctic. A major advantage is that a multirotor UAS can hover over a whale and obtain multiple photos that are more likely to show all regions of the whale clearly, which aids in photo-identification.

The major disadvantage of the TD100 is the high cost of the aircraft and the required flight crew compared to the Phantom 3 Pro. However, the TD100 can fly for 2 hr if battery operated and 8 hr if flown with a fuel powered engine. It can also carry much heavier payloads including 2 or more sensor packages, such as the high-resolution Nikon D810 with a Zeiss lens in addition to video cameras and/or IR cameras. Flights would be easier to conduct and more efficient for the TD100 if flight restrictions were relaxed because it could be operated farther from the ground control station and could be used to find whales beyond visual range of the ground crew.

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